direct effect of lightning, and this number does not include the 109 that were cremated in buildings fired by electric bolts. Of the live stock 9 were killed in barns that were struck and not fired; the others were in yards and fields.

And we are again confronted by the fact that wire fences are directly responsible for a very large percentage of the loss of live stock in the fields. The reports show that of the 581 farm animals killed by lightning, 395, or 68 per cent of the whole number were "electrocuted," while in close contact with wire fences.

* * * * * * *

These are astounding figures, and vastly more effective and convincing than volumes of scientific theories relating to this matter. It appears that the stock growers of this State are paying a very heavy tax on their wire fences, in addition to the cost of construction. Or, possibly, these losses by lightning may not be considered a tax on that kind of fence, but rather a penalty for not constructing the fences properly, with necessary safeguards against such casualties. It is clear that some means should be devised to render wire fences less deadly, or, failing in that, they should be discarded altogether. It is believed that they may be rendered practically safe by the use of ground wires.

The fact may be noted that many of the storms of the past season have been accompanied by driving winds, with more or less hail, as well as an unusual amount of electric disturbance. During the prevalence of that class of storms farm animals in the fields seek closer companionship, and by the force of the storms are driven and crowded together in bunches or herds against the fences that obstruct their way. The reports show that many animals were killed in bunches by single strokes of lightning. * * * * * *

Nearly 30 per cent of the reports show that the strokes occurred on high and dry lands, somewhat distant from timber; and 20 per cent in or near groves or timber lots. This may signify merely that more stock is pastured on high and dry than on low, moist, or timbered lands; and also that buildings are generally erected on elevated and dry sites.

It appears to be certain that isolated trees in pastures are sources of danger to stock or persons that seek shelter under their branches, and it is probably true that dense groves or heavy timber afford a measure of protection against electric force, as well as the other elements of severe storms. The conclusion of the matter is that the safest retreat for man or beast during a thunderstorm is in a building protected by a well constructed rod or metallic roof. * * * *

I am convinced that a very large percentage of losses by lightning may be prevented, and the special purpose of our investigations should be to discover the means of prevention. An ounce of prevention is better than a pound of indemnity.

VAPOR PRESSURE FOR WATER AND ICE.

In comparing and liquefying ordinary air the atmospheric moisture makes much trouble for manufacturers, therefore the following extracts from recent correspondence may be of general interest:

My problem is to dry the air before cooling it for liquefaction by cold. The data which I can not find are those for saturation of air at high pressures and very low temperatures. The pressure in point is 1,500 pounds per square inch. What is the humidity of air at that pressure and from 60° F. down to 312° below zero Fahrenheit? At the lower temperature the pressure might not be over 300 pounds per square inch.

My idea is that the air which is taken into the machine perhaps unsaturated at the pressure and the temperature of the day soon becomes saturated by cooling, and the water vapor freezing is a source of trouble, clogging the pipes. The relation of the very high pressure employed to the relative humidity I am not so sure about, and on this I would like your opinion. Are there any tables for humidity and high pressures?

I am of the opinion that there is no way to remove the trouble but to dry the air chemically. Is air more easily dried at a low pressure, or at a high pressure?

The people using compressed air pass it through cold water, cooling it below the temperature at which it is to be used. When heated again for use it becomes unsaturated. But if it should be still further cooled instead of being heated, it would then deposit still more moisture, would it not?

The following is an extract from the reply:

The quantity of vapor, which a given space can contain, depends altogether on the temperature and only on the temperature. In your particular case we would say that the moisture per cubic foot of air at a pressure of 1,500 pounds per square inch could not be any greater than with same air at atmospheric pressure. Perhaps this broad statement needs a little qualification. Regnault measured the maximum vapor pressure in vacuo, that is, when no other gases were present, and he afterward measured this same pressure when ordinary air was present. According to some physical theories these two pressures should be the same. The very slight differences noticed in his results may plausibly be considered to be due to the slow diffusion of the vapor through the air and the difficulty of obtaining complete saturation under such circumstances. While this effect must exist in air undergoing compression, yet, we are satisfied that the statement made above may be regarded as substantially true, namely: That any given space, saturated with aqueous vapor, will contain the same amount, irrespective of any amount of air, that may be in that space at the same time. This is more particularly true, we think, in case of air subjected to compression, as the question of diffusion does not enter in the same way.

You are quite right in concluding that air undergoing compression soon becomes saturated, but not because it is cold, as a rule, but as a result of the compression itself. The air originally drawn in may not be saturated, but sooner or later, as the compression proceeds the moist vapor present is compressed to a pressure equal to the maximum pressure corresponding to the temperature at which it exists, and any further compression must cause condensation unless the temperature is increased. Of course, ordinarily, the temperature does increase, but the air is presently passed into some sort of cooling apparatus and then condensation takes place there.

In regard to drying the air artificially, the above statement indicates one way by which it can be done, viz, to cool it considerably after compression, thereby literally freezing out, so to speak, all the moisture it contains. The residual water vapor in air at a temperature of 60° below zero, for example, is almost inappreciable. In other words, such air is practically dry.

In regard to drying air chemically, I think it can be more completely dried at a low than at a high pressure. On this point I beg to refer you to the experiments made by Professor Morley, American Journal of Science (3), xxx, p. 140, and (3), xxxiv, p. 199.

Compressed air which has passed through water may be regarded as practically saturated with water vapor, and, as you say, if afterward cooled below the temperature of the water, it will deposit more moisture.

There are no tables treating of humidity at high pressures, because the ordinary tables answer the same purpose.

In addition to the previous remarks, the Editor submits the following small table, which is an abstract of the larger one published by Juhlin in the Proceedings of the Swedish Academy at Stockholm, and reprinted in the Meteorologische Zeitschrift for March, 1894, Vol. XI, p. 98. This table gives the elastic force, or the so-called tension of pure aqueous vapor in a space that is saturated at the respective temperatures. It will be seen that the pressures when liquid water is present in the inclosure are larger than when only particles of ice are present; therefore it is supposed that there are these two forms of aqueous vapor because the pressure of water is so appreciably different from the pressure in the presence of ice. The differences found by Juhlin agree almost exactly with those published by Professor Marvin in his report as contained in the Report of the Chief Signal Officer for 1891.

Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.	Temp.	Water vapor.	Ice vapor.
° C.	Mm.	Mm.	° C.	Mm.	Mm.	° C.	Mm.	Mm.	° C.	Mm.	Mm.
0	4.62	4.60	—13	1.74	1.53	—26	....	0.46	—39	....	0.13
— 1	4.30	4.25	—14	1.61	1.40	—27	....	0.42			
— 2	3.99	3.92	—15	1.49	1.28	—28	....	0.38	—40	....	0.12
— 3	3.71	3.62	—16	1.38	1.17	—29	....	0.34	—41	....	0.11
— 4	3.45	3.33	—17	1.28	1.06				—42	....	0.10
— 5	3.20	3.07	—18	1.18	0.97	—30	....	0.31	—43	....	0.09
— 6	2.97	2.82	—19	1.09	0.88	—31	....	0.28	—44	......	0.08
— 7	2.76	2.59				—32	....	0.26	—45	....	0.08
— 8	2.56	2.38	—20	1.00	0.81	—33	....	0.23	—46	....	0.07
— 9	2.37	2.18	—21	....	0.73	—34	....	0.21	—47	....	0.06
			—22	....	0.67	—35	....	0.19	—48	....	0.06
—10	2.20	2.00	—23	....	0.61	—36	....	0.18	—49	....	0.05
—11	2.03	1.83	—24	....	0.55	—37	....	0.16			
—12	1.88	1.67	—25	....	0.50	—38	....	0.15	—50	....	0.05

The excess of the vapor pressure for aqueous vapor over that for ice vapor attains its maximum, 0.214 mm. at the temperature of —15.5° C.

Of course if one wishes to dry the air before cooling it down to the point of liquefaction, one must have some independent method of doing it. If we already have at our disposal a quantity of liquefied air at a temperature of about —200° C. we may utilize this in order to dry any other mass of air. If any vessel containing air is immersed in a bath of liquid air it is at once cooled so intensely that all the moisture it contains is precipitated as frost on the sides of the vessel. Whatever gaseous moisture is left in the air at this low temperature is entirely inappreciable to our methods of measurement. This air may, therefore, be considered practically dry and may be passed on into other vessels for such experiments as our correspondent has in mind.

The different tensions of ice vapor and water vapor are explained in an important memoir by Prof. M. Thiesen, of Berlin, which we hope to publish for the information of our readers.

TEMPERATURE AND MOISTURE OF SOILS IN RED RIVER VALLEY.

In the October report of the North Dakota Section, Mr. B. H. Bronson publishes the first part of an excellent paper entitled Some Studies in Meteorology, by Prof. E. F. Ladd of the Agricultural College at Fargo, N. Dak. Professor Ladd says that he proposes to publish the results of the continuous observations made at that place since August, 1891. His first study relates to the question of earth temperatures, the depth of the frost, and the quantity of moisture offered to the growing wheat by the thawing of the soil when the rainfall is small and even deficient, upon which matters misconceptions seem to have arisen.

The temperatures of the soil have been determined by means of thermometers at eight different depths, viz, 1, 3, 6, 12, 24, 48, 60, and 84 inches. The instruments were of the pattern designed by Dr. Sturtevant for use at the New York State Experiment Station. In only one winter, that of 1895, did the frost line reach down 5 feet, but each year it passed below 4 feet. The frost was all out of the ground by the 20th of May each year, with a possible exception of 1892–93. It is evident, therefore, that the gradual thawing of the frozen ground, during the summer months can not be a source of moisture to supply the growing crop of wheat. The fact is that the soils of the Red River Valley have the power of holding large quantities of water in storage.

The mean temperature of the soil at different depths, as observed daily at midday for seven years, 1892–1898, is shown in the following table:

Months.	Depth of thermometer, in inches.							
	1.	3.	6.	12.	24.	48.	60.	84.
May	56,6	50.8	46.8	43.9	38.7	34.3	33.7	34.8
June	67.0	61.9	58.8	57.6	51.0	41.0	40.9	38.0
July	74.1	67.9	65.2	63.6	59.3	53.1	49.1	43.7
August	75.6	66.2	64.5	63.5	61.0	56.0	52.9	47.4

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Meteorological Records.

The chief characteristics of the month were high temperatures, relatively heavy rains for the season, light winds, and an absence of severe local or general storms.

Cloudiness was generally greater than usual and the relative humidity of the air was in excess of the normal in the majority of districts.

PRESSURE.

The distribution of monthly mean pressure, shown by Chart IV, differs in several important particulars from the normal distribution for October. The most important departure from normal conditions was the apparent shifting of the area of high pressure usually found over Georgia and South Carolina, to the Middle Atlantic and New England States. It will also be noticed that the monthly means over the last-named region average about 30.20 inches, which value is greater than the local normal October pressures, and also greater by a tenth of an inch than the normal October pressure over the south Atlantic States.

The configuration of the monthly mean isobars follows a summer type more closely than an autumnal one, and is typical of a wet rather than a dry month in the interior valleys and generally to the westward. In a dry October the monthly mean isobars generally run east and west, and the two dominating highs are frequently joined in a ridge of high pressure extending from the Georgia coast to the Plateau region.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

East of the one hundredth meridian the temperature was above normal by amounts ranging from 6° and 8°, daily, in the middle Mississippi Valley, to less than a degree on the Atlantic coast. West of the above-mentioned meridian temperature was below normal by amounts ranging from 4° in eastern Oregon to less than a degree on the Pacific coast.

A period of abnormally high temperature in the central and eastern portions of the country set in about the 10th and continued until about the 25th. During this period unusually high temperatures were recorded in the Mississippi and Missouri valleys, the Lake region, and eastward to New England.

The lines of freezing temperatures did not extend so far south as in the corresponding month of 1898, and in general the minimum temperatures were not so low as in that year, while the maximum temperatures were higher.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	52.8	+ 1.9	+ 2.2	+ 0.2
Middle Atlantic	12	58.3	+ 2.5	+ 0.7	+ 0.1
South Atlantic	10	66.0	+ 1.9	+ 2.0	+ 0.2
Florida Peninsula	7	65.1	+ 1.4	+ 3.5	+ 0.4
East Gulf	7	69.3	+ 2.5	− 1.7	− 0.2
West Gulf	7	70.9	+ 3.8	+ 1.6	+ 0.2
Ohio Valley and Tennessee	12	61.6	+ 4.9	+ 4.8	+ 0.4
Lower Lake	8	56.2	+ 4.9	+ 6.4	+ 0.6
Upper Lake	9	51.9	+ 5.0	− 1.0	− 0.1
North Dakota	7	43.4	+ 0 8	−18.6	− 1.9
Upper Mississippi	11	58.8	+ 6.1	− 1.0	− 0.1
Missouri Valley	10	57.9	+ 5.2	− 4.0	− 0.4
Northern Slope	7	44.4	− 1.8	−25.0	− 2.5
Middle Slope	6	58.8	+ 3.6	− 3.2	− 0.3
Southern Slope	6	65.3	+ 4.1	− 4.7	− 0.5
Southern Plateau	13	57.9	− 1.6	− 6.5	− 0.6
Middle Plateau	9	46.8	− 3.2	−14.3	− 1.4
Northern Plateau	10	45.7	− 3.2	−16.9	− 1.7
North Pacific	9	51.1	− 0.8	−12.4	− 1.2
Middle Pacific	5	58.2	− 1.3	− 4.9	− 0.5
South Pacific	4	61.5	− 1.9	− 5.5	− 0.6